EFFECTIVENESS OF AN INTERVENTION FOR REDUCING SCHOOL BACK PACK WEIGHTS AMONG SCHOOL STUDENTS AT SELECTED SCHOOLS IN KANYAKUMARI DISTRICT, TAMILNADU – A MIXED METHODS STUDY

SYNOPSIS

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TABLE OF CONTENTS

S.NO	CONTENTS	PAGE NUMBER
1	Structured Abstract	1
2	Introduction	4
3	Aim and objectives	5
4	Research questions	6
4	Subject and methods	7
5	Results	17
6	Discussion	21
7	Limitations	24
8	Conclusion	25
9	References	27
10	List of Scholarly activities	28
11	First page from the reprint of the Published articles	31
12	Annexures	36

ABSTRACT

Introduction : In the whole span of life, education plays a very important role. Basic education not only provides knowledge but also fosters strong personality, social, moral, physical, and psychological development. Schools are settings where children spend a substantial portion of their waking hours, and these environments must support both learning and health. The World Health Organization (WHO) emphasizes the importance of schools as settings that promote physical and mental well-being and protect children from health risks, highlighting that effective school health programmes can influence healthy behaviours and prevent injury throughout childhood and adolescence[1]. The Centres for Disease Control and Prevention (CDC) underscores the role of safety and injury prevention in educational settings, noting that early care and school programmes should actively protect children from serious harm and teach foundational skills to prevent injuries[2]. Additionally, UNICEF advocates for healthy environments that support child development and well-being, stating that every child has the right to a healthy environment that enables them to thrive and reach their full potential[3].

An overlooked risk factor in school environments is the excessive weight of school bags carried by children. Carrying heavy backpacks has been associated with multiple physical health issues such as chronic back and neck pain, musculoskeletal strain, posture deformities, and reduced academic performance due to discomfort and fatigue. Long-term physical burdens can contribute to psychological issues such as anxiety, depression, and mental stress among students. Only a few studies have examined this problem in the Indian context. Hence, this interventional study was conducted to evaluate the effectiveness of an intervention programme for reducing school bag weights among school students at selected schools in Kanyakumari district of Tamil Nadu.

Objectives :

Primary objectives :

1. To study the effectiveness of intervention program for reducing school bag weight among school students carrying backpack.

Secondary objectives:

1) To assess upper and lower abdominal pain by using Visual Analog Scale in school children before and after intervention.
2) To assess specific area related musculoskeletal pain & discomfort by using Nordic scale in school children before and after intervention.

3) To assess Muscle strength of back and abdominal musculature using Manual Muscle Testing Kendall method in school children before and after intervention.
4) Assessing the awareness of Principals, Teachers, Parents about school back pack weight.
5) To assess the stress level of school students by using Depression Anxiety Stress Scale in children before and after intervention.

Methods :

A school-based interventional prospective mixed-method study was conducted among 1404 students from 18 schools out of selected 54 schools in Kanyakumari district of Tamil Nadu, using stratified cluster random sampling technique. A qualitative analysis on the effects of heavy school bags on the health of students involved exploring the subjective experiences, perceptions, and feelings of students, parents, and teachers. A total of 16 focus group discussions were conducted among principals, teachers, students and parents of the students of selected institutions under the study until redundance of data is obtained.

For the quantitative analysis, data were collected on independent variables like sociodemographic factors, anthropometric measurements, reasons for heavy bag pack, sources of hearing guidelines regarding weight of school bag, problems experienced by a student while carrying back pack etc. Dependent variables like upper and lower abdominal pain was evaluated using Visual Analog Scale. Specific area-related musculoskeletal pain and discomfort assessed by using a NORDIC musculoskeletal scale. Muscle strength of back and abdominal musculature was assessed by Manual Muscle Testing Kendall method. Stress assessment was done by using the DASS 21 scale. Effectiveness of intervention program was assessed by looking for a reduction in heavy backpack carried by school children after giving intervention to them.

All collected data was entered into Microsoft Office Excel 2022 and analysis was done using SPSS trial version 20. All qualitative variables expressed as frequency and percentages and quantitative using mean and standard deviation. McNemars Chi square test, Pearson Chi square test and Fischer's exact test was used as tests of significance. p value less than 0.05 was considered as statistical significance.

Results : The observations of qualitative analysis were discussed under the headings as follows - situational analysis, reasons of heavy bags, perception about the impact of heavy bags, methods of use of school bags, suggestions for reducing bag weight, measures to be taken for reducing the burden due to homework, challenges in reducing the weight of bags. The study

observed that almost all the participants were unaware of the school bag policy 2020. The qualitative analysis showed that there is a concerning lack of awareness among parents regarding maximum acceptable school bag weight. Shoulder and neck pain were commonly reported among students and those who had to walk long distance suffered more pain and fatigue. Very few schools had locker facility but students are not using it because of the fear of missing things.

Quantitative analysis found that there was significant reduction noted in the proportion of heavy backpack users in the experimental group as compared to the control group (p value <0.001) proving the effectiveness of the intervention. After intervention, the upper and lower abdominal discomfort, musculoskeletal pain/discomfort and stress perceived by students dropped significantly whereas muscle power, academic performance improved in the experimental group ($p<0.001$). BMI is an associating factor and underweight students are more likely to be affected by heavy school bag packs (p value < 0.001). Carrying backpack on both shoulders and availability of mid-day meal in schools was found to be associated with the weight of school bag pack (p value <0.05). Nearly one-third of the study subjects in both the groups (heavy backpack weight and normal backpack weight) received guidelines regarding backpack weight previously. There is no statistically significant association observed between backpack weight and guidelines received previously regarding backpack weight among them (p value >0.05).

Conclusion : This study has thrown light on the detrimental impacts of heavy school bags and the positive changes that can be brought about by a simple, cost-effective intervention. Large-scale influencing and awareness are needed for educational administrators, school heads, teacher educators, teachers, parents, and students at all levels to address the issue of heavy school bags. A positive step has been taken with the recent announcement of the Policy on School Bag 2020 by the Ministry of Education, Government of India's National Council of Educational Research and Training.

Keywords: School back pack weight, intervention, mixed-method study, school bag policy, heavy school backpack, cluster stratified random sampling.

1. INTRODUCTION

Purpose of the research:

The potentially adverse effects of students' heavy backpacks are a public concern and must be considered by the scientific and educational community[1],[2],[3]. National and international reports in the public and the professional press have been sending alarming messages that the prevalence of back pain in children is rising and is resembling the prevalence of back pain in adults[4]. Due to the recent popularity of the subject of children and backpacks, additional research in this area would only strengthen the understanding of the problem. Even though "American Occupational Therapy Association," "American Academy of Orthopedic Surgeons," and "International Chiropractic Pediatric Association" recommended that the children should not carry a load more than 10% of their body weight, children continue to carry heavy school bags[5],[6]. Awareness among students, teachers, parents to restrict backpack load not heavier than 10% of the children's body weight. Along with appropriate ergonomic intervention is necessary. Hence, need is felt to test different strategies to reduce the weight of school bag. Only few interventional studies done specially from India. Hence this study was done to assess the effectiveness of intervention program for reducing school bag weight among school going students.

Research Hypothesis:

H1 (RESEARCH/ALTERNATIVE HYPOTHESIS):

The ergonomic intervention program is effective in reducing school backpack weight and improving musculoskeletal health, academic performance, and stress levels among school students compared to those who do not receive the intervention.

H0 (NULL HYPOTHESIS):

The ergonomic intervention program has no significant effect on school backpack weight, musculoskeletal health, academic performance, or stress levels among school students compared to controls.

2. AIMS AND OBJECTIVES

PRIMARY OBJECTIVE:

1. To study the effectiveness of intervention program for reducing school bag weight among school students carrying backpack.

SECONDARY OBJECTIVE:

1) To assess upper and lower abdominal pain by using Visual Analog Scale in school children before and after intervention.
2) To assess specific area related musculoskeletal pain & discomfort by using Nordic scale in school children before and after intervention.
3) To assess Muscle strength of back and abdominal musculature using Manual Muscle Testing Kendall method in school children before and after intervention.
4) Assessing the awareness of Principals, Teachers, Parents about school back pack weight.
5) To assess the stress level of school students by using Depression Anxiety Stress Scale in children before and after intervention.

3. RESEARCH QUESTION

Research Question:

1. What is the effectiveness of intervention program for reducing school bag weight among school students carrying backpack?
2. What are the factors required for reducing school back pack weight?
3. What are the musculoskeletal pain and discomfort occurred by carrying school back pack weight?

4. SUBJECTS AND METHODS

Operational definitions of terms pertaining to this study:

a) School bag: "A bag that is used for carrying books, etc. for school, usually with a long strap and carried over the shoulder, or carried on the back like a backpack"(158)

b) Academic performance:
Good: >80% marks secured in all subjects
Moderate:>50% and <80% marks secured in all subjects
Poor:<50% marks secured in all subjects

4.1 STUDY SUBJECTS

Selected school children studying in 6^{th}, 7^{th}, 8^{th} standard of selected schools in Kanyakumari District.

Focused Group Discussion has been done on four groups

Group 1: Teachers from the selected class

Group 2: Parents of the selected school children

Group 3: Principals of the selected schools

Group 4: Students of the selected schools

These groups also included in the study population

4.2 TYPE OF STUDY

Interventional prospective study design.

This is a Exploratory Sequential mixed-method study which consisted of both quantitative and qualitative components.

Quantitative: School based Randomized control trial design

Qualitative: Focus group discussion

4.3 PLACE OF STUDY

This community-based study was conducted in selected schools of Kanyakumari district, Tamil Nadu. The total area of the Kanyakumari district is 1672 km^2. As per the information obtained from Chief Educational Officer (CEO), Kanyakumari district, total number of schools in the district is 1232. In that, 682 schools contain 6^{th}, 7^{th} and 8^{th} standard which is considered to be the study population for this study. The study was conducted in 18 schools out of selected 54 schools of Kanyakumari District among selected school children studying at 6,7,8 standards.

4.4 SELECTION PROCESS

4.4.1 STUDY POPULATION

Selected school children studying in 6^{th}, 7^{th}, 8^{th} standard of selected schools in Kanyakumari District.

Focused Group Discussion was done for four groups

Group 1: Teachers from the selected class

Group 2: Parents of the selected school children

Group 3: Principals of the selected schools

Group 4: students of the selected schools

These groups also included in the study population.

4.4.2 INCLUSION CRITERIA

a) Selected school children studying in 6^{th} ,7^{th} ,8^{th} standard of Kanyakumari district.

b) School students and parents willing to participate and who had given written informed consent form and assent form to participate in the study.

4.4.3 EXCLUSION CRITERIA

a) Students diagnosed with known musculoskeletal problems.

b) Students diagnosed with a known psychiatric disorder.

c) Students who were absent in the school on the day of data collection.

d) Students who are physically handicapped

4.4.4 SAMPLING PROCEDURE

A Stratified Cluster Random Sampling has been done. Total list of schools is divided into rural area and urban area based on location of schools Again the schools are sub divided

(a) Government, Semi Government, Private based on their administration of the management

(b) Type of school Boys, Girls, Coeducation.

One section from each selected school has been selected in interventional arm and control arm (Rural area and urban area). For Interventional group the intervention has been done and for control group intervention has not been done.

A Stratified Cluster Random Sampling has been done among schools by getting the data from the CEO office

4.4.5 STUDY GROUPS

1. **Quantitative Study Groups (Randomized Controlled Trial)**

Intervention Group

- ✓ **Sample size:** 702 school students
- ✓ **Classes:** 6th, 7th, and 8th standards
- ✓ **Setting:** Selected urban and rural schools of Kanyakumari district
- ✓ **Intervention received:** Ergonomic education on posture, Ideal backpack carrying & lifting techniques, Backpack modifications, Desk stretches, breathing exercises, Core and back strengthening exercises

Control Group

- ✓ **Sample size:** 702 school students, Classes**:** 6th, 7th, and 8th standards
- ✓ **Setting:** Matched schools (urban & rural), **Intervention:** No ergonomic intervention
- ✓ **Assessments:** Same tools and time points as intervention group

Total quantitative sample: 1404 students

2. Qualitative Study Groups (Focus Group Discussions – FGDs)

A **purposive sampling** method has beenss used.

FGD Group 1 – School Principals, FGD Group 2 – Teachers, FGD Group 3 – Parents

FGD Group 4 – Students Total FGDs: 16

SAMPLE SIZE: The formula required is

.

$$N = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 P(1-P)}{(P_1-P_2)^2}$$

$Z_{1-\alpha/2}$=1.96 at 95% confidence with α=0.05

$Z_{1-\beta}$=0.84 at 80% of power with β=0.20

P1= 25%= 0.25 (P1= proportion of children who are carrying backpack weight >10% of body weight after giving intervention to them. This proportion is taken from the pilot study done previously)

P2= 34% = 0.35 (P2= proportion of children who were not given intervention and they are carrying backpack weight >10% of body weight. This value of proportion is taken from the pilot study which is done previously)

P=(P1+P2)/2 = 0.3

$$N = \frac{2(1.96+0.84)^2 * 0.3(1-0.3)}{(0.1)^2}$$

= 329.28

Considering design effect for cluster sampling method.

Sample size = 2 * 329.28 = 658.56

Considering non-response rate for this study as 5%.

Sample size = 691.488 = **700**

n=700 in each group (Interventional group, Control group)

The total sample size is rounded to **1400**. Sample size used for our study **1404.**

Qualitative study :

16 Focus Group Discussions (FGD) Principals, Teachers, Parents, Students

4.4.6 SAMPLING TECHNIQUE :

Stratified Cluster Random Sampling technique has been used as sampling technique.

The Chief Educational Officer (CEO) of Kanyakumari district has provided a list of all the schools in the district, and the schools were separated into two categories based on where they were located (rural and urban areas). About 682 of the 1232 schools in the Kanyakumari area had sixth-, seventh-, and eighth-grade classrooms; the students in these schools were the study population for the current study. Each school is considered to be a cluster. 54 schools were selected from the 682 schools (27 schools each in urban and rural areas) using a simple random sampling technique- lottery method.

Again, the schools in urban and rural areas were divided using a simple random sampling technique (lottery method) based on the type of school i.e., boys' school, girls' school, and co-education school. Thus, 18 schools each were selected from boys' schools, girls' schools, and co-education schools respectively.

Thereafter, the schools that are divided based on the type of school (boys, girls, and co-education school) are again subdivided based on their administration of management (Government, semi-government, and Private) using a simple random sampling technique – lottery method. 6 schools each were selected from Government schools, semi-government schools, and private schools respectively from boys, girls, and co-education schools.

Since the syllabus in private schools is different for each school, private schools were again divided into schools with ICSE, CBSE, and State syllabus. ICSE, CBSE, and State syllabus (13 students from each syllabus school is selected separately Intervention and Control group in Rural and urban area separately. If the any of the ICSE, CBSE, and State syllabus schools are not there in the Group the other syllabus school students are selected) Among the selected 6 schools, 1 school were selected using simple random sampling technique. Then, 39 students each from 1 school studying in 6^{th}, 7^{th}, and 8^{th} standard each were selected from selected schools using a simple random sampling technique (lottery method). Names of the students were obtained from the attendance register. Selected 39 students from one school were given intervention and the 39 students from the second school were not given any intervention. In total, 702 students were given intervention and the remaining 702 students were not given any intervention. Flow chart of sampling technique for selecting study participants for the present study are given below (Fig No.1).

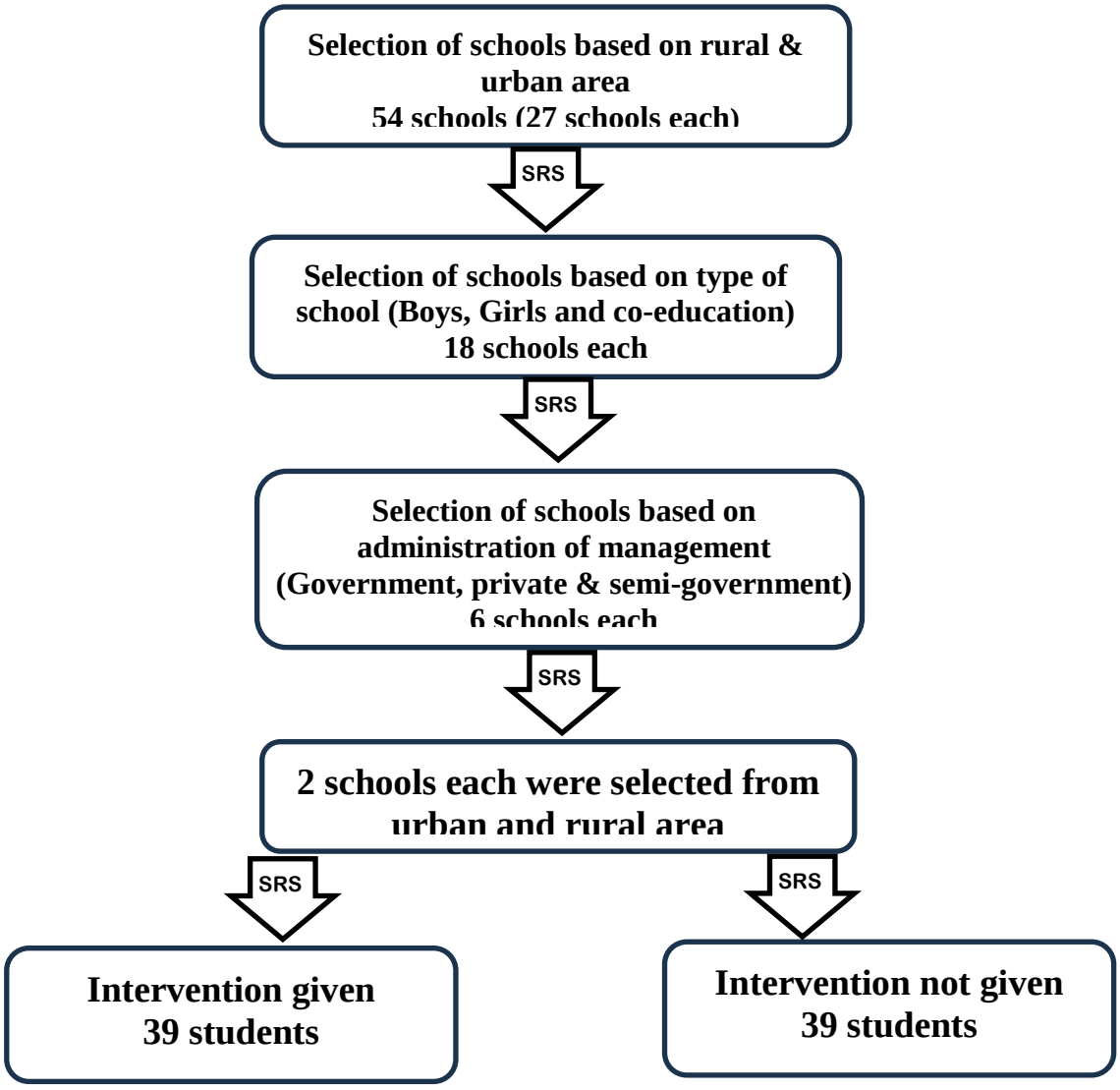

Selection of schools based on rural & urban area
54 schools (27 schools each)
SRS
Selection of schools based on type of school (Boys, Girls and co-education)
18 schools each
SRS
Selection of schools based on administration of management (Government, private & semi-government)
6 schools each
SRS
2 schools each were selected from urban and rural area
SRS
SRS
Intervention given
39 students
Intervention not given
39 students

Fig No.1: Flowchart showing selection of study subjects for the study
*SRS- Simple Random Sampling.

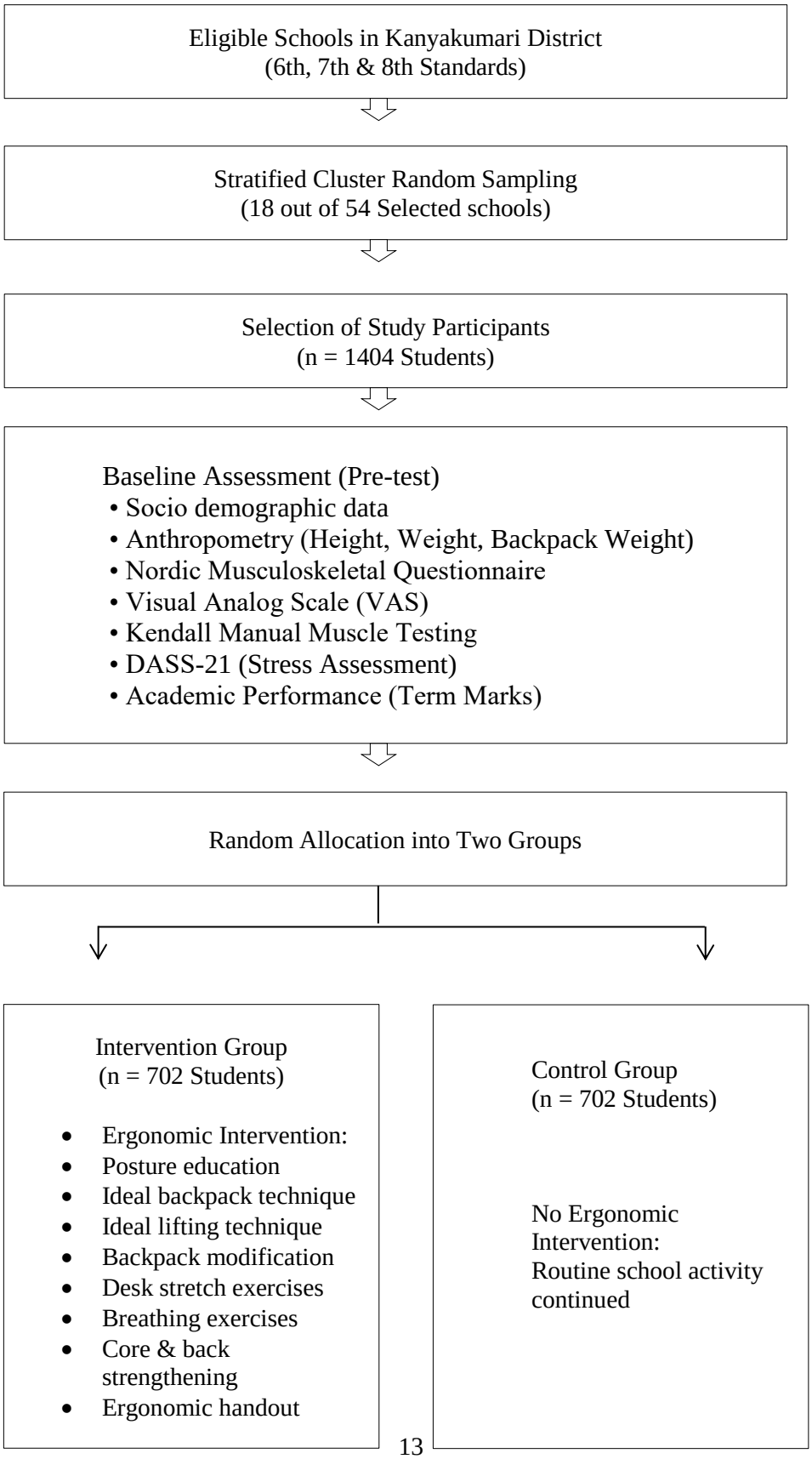
		Urban (27 schools- 702 students)		**Rural (27 schools- 702 students)**	
		Intervention (351 students)	**Control (351 students)**	**Intervention (351 students)**	**Control (351 students)**
Boys school (18 schools)	**Government (6 schools)**	39 students	39 students	39 students	39 students
	Private (6 schools)	39 students	39 students	39 students	39 students
	Semi-government (6 schools)	39 students	39 students	39 students	39 students
Girls school (18 schools)	**Government (6 schools)**	39 students	39 students	39 students	39 students
	Private (6 schools)	39 students	39 students	39 students	39 students
	Semi-government (6 schools)	39 students	39 students	39 students	39 students
Co-education (18 schools)	**Government (6 schools)**	39 students	39 students	39 students	39 students
	Private (6 schools)	39 students	39 students	39 students	39 students
	Semi-government (6 schools)	39 students	39 students	39 students	39 students

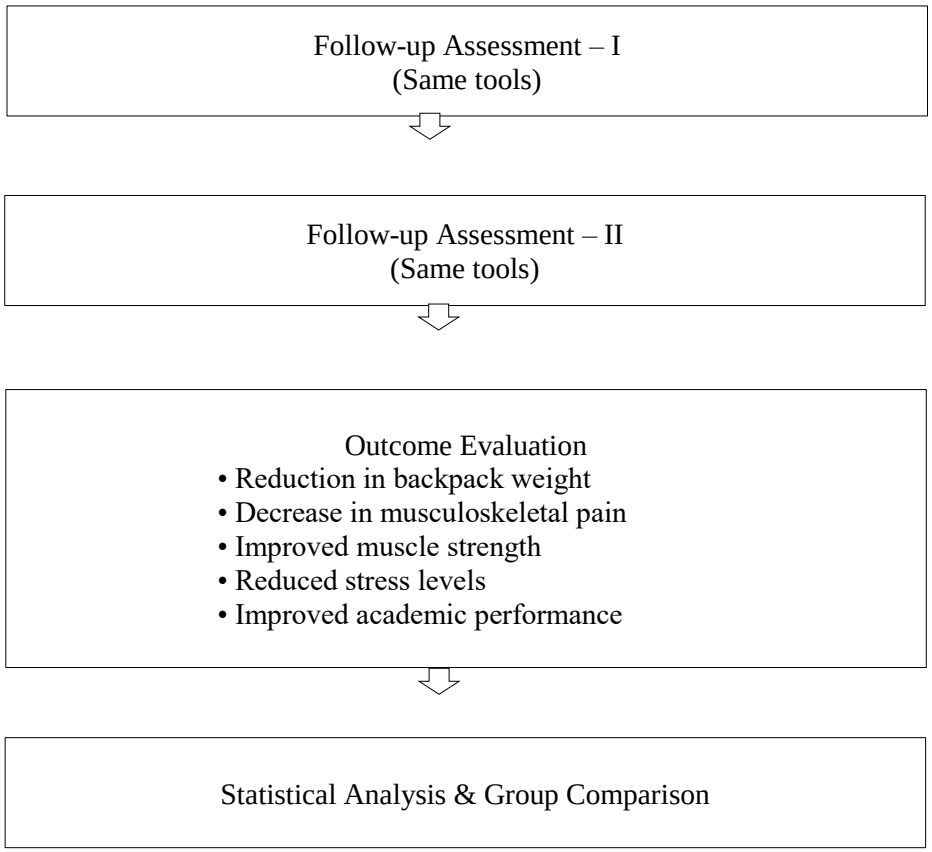
Table No1: Allocation of study subjects into interventional and control groups (n=1404)

QUALITATIVE STUDY: Purposive sampling technique was used.

4.5 METHODOLOGY / PROCEDURES

Study Design Flow Diagram




Follow-up Assessment – I
(Same tools)
Follow-up Assessment – II
(Same tools)
Outcome Evaluation
• Reduction in backpack weight
• Decrease in musculoskeletal pain
• Improved muscle strength
• Reduced stress levels
• Improved academic performance
Statistical Analysis & Group Comparison

4.4.6 INTERVENTIONS USED

An ergonomic intervention program was done among students in the interventional group which included;

1) **Posture education:** Participants received instruction in posture correction techniques. Teaching the appropriate posture for sitting and standing involves both auditory and visual signals (mirror feedback). Sit on a chair and table that are the right height, with the shoulders back and the elbows supported by the armrests, if at all feasible was advised. Quick desk stretches are taught to the participants, and lumbar support is encouraged. The participants were shown and instructed in these desk stretches using the related pictures. Advice regarding proper standing posture is also given like standing with back straight, legs at the right distance apart, and knees locked.
2) **Ideal carrying technique:** The best carrying method for a backpack was taught to the participant. Both the shoulders and the back are used to carry the backpack. Not too low and loosely hanging, should appropriately fit around the lower curve of the spine.
3) **Ideal lifting technique:** The best lifting methods for a backpack are demonstrated. Stand as near as possible to the backpack. Picking up a backpack from a lower surface or the floor requires bending both knees while maintaining a straight back (squat lift).
4) **Backpack modifications:**
   - **a)** Rest on the student's back, between the curve of the lower back and the neck.
   - **b)** Include two padded, curved shoulder straps for wades.
   - **c)** Added padding at the back for comfort
   - **d)** Hip and chest straps help distribute the weight and preserve stability; they should be long enough to hold the bag close to the back but not so long or tight as to prevent wearing both straps.
   - **e)** Multiple compartments to ensure more uniform weight distribution
   - **f)** The bags' padding should be made of soft material or gel.
5) **Breathing exercises**: Students were instructed on deep breathing exercises.
6) Exercises to increase the range of motion in the neck, shoulder, and scapula.
7) **Desk stretch exercises**: Encourage frequent position changes and be aware of which positions to enter to "undo" a position. It involved stretching the neck, pectorals, fingers, upper middle back, shoulders, and sides. The handout of ergonomic intervention which includes above mentioned seven interventions, was given to the study participants. Hence, better compliance was expected from the study participants in the interventional group.

5.STUDY VARIABLES

Independent variables included sociodemographic factors (age, gender, class, religion, type and area of school), anthropometric measures (height, weight, backpack weight, backpack weight as percentage of body weight), backpack-related factors (type of bag, contents, duration of carriage, mode of transport, and carrying method), and school/lifestyle factors (homework load, locker facility, extracurricular activities, physical education/yoga/meditation, travel duration, and awareness of school bag weight guidelines).

Dependent variables were the effectiveness of ergonomic intervention assessed by reduction in heavy backpack carriage (>10% body weight), musculoskeletal pain and discomfort (Nordic Musculoskeletal Questionnaire), pain intensity (Visual Analog Scale), back and abdominal muscle strength (Kendall Manual Muscle Testing), stress levels (DASS-21), and academic performance categorized based on examination marks.

Confounding variables included growth-related musculoskeletal changes, sedentary lifestyle, poor posture, pre-existing minor musculoskeletal discomforts, and home study environment.

Outcome variables comprised reduction in backpack weight, reduction in musculoskeletal pain and discomfort, improvement in muscle strength, reduction in stress levels, and improvement in academic performance.

6.DATA COLLECTION

The study was conducted among 1,404 students selected from 54 schools in Kanyakumari district. Students were randomly allocated into intervention and control groups. Data collection was carried out in three phases: baseline assessment and intervention (September 2022), first follow-up after five months (March 2023), and final follow-up after another five months (September 2023). Baseline assessment included questionnaire data, anthropometric measurements, Nordic Musculoskeletal Questionnaire, Visual Analog Scale, Kendall muscle strength testing, DASS-21 stress assessment, and academic performance evaluation. Each participant required approximately 45 minutes for assessment. Ergonomic intervention was administered only to the intervention group without affecting routine academic activities. Focus group discussions were conducted among teachers, parents, and school principals to assess awareness regarding school bag usage and related health issues.

STATISTICAL METHODS

Data were entered in Microsoft Excel and analyzed using SPSS Trial version 20.0. Descriptive statistics (mean, frequency, percentage, and standard deviation) were used. Paired t-test assessed changes in mean backpack weight, and Chi-square test compared proportions of heavy backpacks between groups. Statistical significance was set at $p < 0.05$.

5. RESULTS

I. QUALITATIVE EVALUATION- OBSERVATIONS

A qualitative study was undertaken to explore the experiences and perceptions related to heavy school bags and their effects on students' health. Data were collected through focus group discussions (FGDs) with principals (3), teachers (4), students (4), and parents (5) from selected institutions. A total of 16 FGDs were conducted until data saturation was achieved. The findings were organized into seven major thematic domains.

1. Situational Analysis

School education is delivered through a prescribed curriculum involving voluminous textbooks and notebooks. Although national guidelines recommend that a school bag should not exceed 10% of a child's body weight, most schools were unaware of or did not implement this policy.

Verbatim: "I have seen my kid carrying heavy bag and not able to stand straight. He leans forward while walking." (FGD-01, Parent)

2. Reasons for Heavy Bags

Textbooks were the primary contributors to bag weight, followed by water bottles, lunch boxes, stationery, and extracurricular materials. Fear of punishment forced students to carry all books daily.

Verbatim: "We are asked to bring all the books to the school. If we forget any book, the teacher punishes us." (FGD-03, Student)

3. Perception of the Impact of Heavy Bags

Heavy bags were perceived to cause fatigue, poor posture, reduced concentration, and musculoskeletal pain.

Verbatim: "Children get burnt out and will not be able to concentrate in class as they are stressed and tired after carrying heavy backpacks." (FGD-04, Parent)

4. Methods of Use of School Bags

Awareness about correct bag usage was poor, with students often carrying bags on one shoulder.

Verbatim: "Many students are carrying their bags on one shoulder, and the entire weight is concentrated on one side." (FGD-02, Teacher)

5. Suggestions for Reducing Bag Weight

Participants suggested timetable-based packing, lockers, lighter books, and digital learning.

Verbatim: "Having one set of books at school and another at home can reduce the weight of school bags." (FGD-05, Parent)

6. Measures to Reduce Homework Burden

Suggestions included in-class homework, online submissions, and curriculum review. **Verbatim: "Schools can review the curriculum and use innovative teaching methods to reduce unnecessary burden." (FGD-02, Principal)**

7. Challenges in Reducing the Weight of Bags

Challenges included financial constraints, digital divide, and curriculum pressure. **Verbatim: "Even though many suggestions are given, what is feasible now is still traditional classroom teaching." (FGD-02, Principal**)

CONCLUSION :

Heavy school bags remain a significant concern due to curriculum load, lack of infrastructure, and limited awareness. Coordinated efforts from stakeholders are essential to safeguard students' health.

II. QUANTITATIVE OBSERVATIONS

Baseline (Pre-test) Status

At baseline, the study population predominantly consisted of students aged 11–12 years (mean age 11.76 ± 0.87 years), with most belonging to the Christian religion (66.8%). A large proportion of parents had education below the graduate level (father: 83.9%, mother: 67.1%), and 60.9% of students were underweight. These sociodemographic and school-related characteristics remained unchanged throughout the 6- and 12-month follow-up period, confirming group comparability.

Regarding school bag characteristics, 72.5% of students carried backpacks exceeding 10% of body weight, primarily due to heavy textbooks (92.6%). Awareness of backpack weight guidelines was poor (77.6% unaware), and overall compliance with recommended backpack practices was low (29.1%).

From a health perspective, 65.8% of students reported musculoskeletal pain at baseline, most commonly low back pain (52.6%) and neck/shoulder pain (48.2%). Abdominal pain of more than mild intensity was observed in 31.4% (upper) and 28.7% (lower) abdominal regions. Poor back and abdominal muscle strength (MMT ≤ Grade 3) was identified in 44.9% of students. Moderate to severe stress, assessed using the DASS-21 scale, was present in 39.6% of students. Academic performance at baseline showed a higher proportion of poor performers in the control group (24.1%) compared to the experimental group (14.4%).

Post-test Results at 6 Months

At the 6-month post-test, substantial improvements were observed exclusively in the experimental/intervention group, while socio demographic and school-related factors remained stable.

The **Ergonomic intervention proved highly effective** at this stage. The proportion of students carrying heavy backpacks reduced markedly from 85.5% at baseline to 55.4% ($\chi^2 = 228.03$, $p < 0.001$), whereas no significant change occurred in the control group ($p > 0.05$). Correspondingly, ergonomic awareness improved to 68.9%, and compliance with recommended backpack practices increased to 63.4%.

Health outcomes mirrored these improvements. Overall musculoskeletal pain decreased from 65.8% to 34.6%, with reductions in neck and shoulder pain (25.3%) and low back pain (28.1%). Upper and lower abdominal pain (VAS > mild) declined to 15.2% and 13.6%, respectively. Poor back and abdominal muscle strength reduced to 22.5%, consistent with a significant increase in Grade 5 muscle power on MMT.

Psychological well-being also improved. Moderate to severe stress declined from 39.6% to 19.8% in the experimental group, while the control group exhibited worsening stress over the same period. Academic performance gains were observed in the experimental group, with 96.7% of students achieving good to moderate performance compared to 55.3% in the control group.

Post-test Results at 12 Months

At the 12-month follow-up, the **effectiveness of the ergonomic intervention was sustained and enhanced**, demonstrating long-term benefits across all measured outcomes.

Heavy backpack carriage further declined to 42.4% in the experimental group ($\chi^2 = 308.49$, $p < 0.001$), while remaining consistently high in the control group (90.2%). Ergonomic awareness increased to 82.7%, and compliance with recommended practices rose to 78.6%, reflecting long-term retention of behavior change.

Musculoskeletal pain showed continued reduction, with only 21.9% reporting pain at any site. Neck and shoulder pain decreased to 14.7%, and low back pain to 16.3%. Upper and lower abdominal pain (VAS > mild) further reduced to 7.9% and 6.8%, respectively. Poor muscle strength was observed in only 11.4% of students, with more than 96% achieving Grade 5 muscle strength on MMT, indicating sustained improvements in musculoskeletal function.

Stress levels showed a marked and lasting reduction, with 9.6% of students experiencing moderate to severe stress, while the control group continued to worsen over time. Academic performance gains were maintained in the experimental group, with 96.7% showing good to moderate performance, whereas nearly half of the control group students (44.7%) continued to perform poorly.

Overall Coordinated Interpretation

Overall, while socio demographic and school-related characteristics remained constant, the **ergonomic intervention resulted in statistically and clinically significant improvements** in heavy backpack carriage, musculoskeletal and abdominal pain, muscle strength, and stress levels, along with substantial and sustained enhancements in ergonomic awareness, compliance with recommended practices, and academic performance at both 6- and 12-month follow-up assessments. The absence of similar improvements in the control group confirms the **short-term effectiveness (6 months) and long-term sustainability (12 months)** of the intervention.

6. DISCUSSION

Summary of Findings and Interpretation

In the initial phase of the present study, a qualitative assessment was conducted among principals, teachers, students, and parents to explore the issues and challenges associated with heavy school backpacks. This preliminary exploration provided important contextual insights that guided the subsequent intervention and interpretation of quantitative findings.

A major concern identified was the **poor awareness of existing school bag policies**. Almost all participants were unaware of the recommended limits for school backpack weight. This finding is consistent with the study by Pant et al. from Ludhiana, which reported that only 6.67% of parents were aware of the Maximum Acceptable School Bag Weight (MASW), recommended to be 10–15% of a child's body weight (166). Similar gaps in parental knowledge and attitudes were observed by Abdul monem Alsiddiky et al., highlighting the urgent need for structured awareness and educational programs targeting parents and teachers (167). Lack of orientation and training appears to be a key contributor to continued non-compliance with school bag guidelines.

Another structural issue highlighted was the **limited provision and utilization of locker facilities**. Evidence from New Zealand schools showed that locker availability varied widely, with only 57.1% of younger students and 7.1–85.7% of older students having access, and a significant proportion of students rarely or never using lockers due to inconvenience, time constraints, or fear of theft (168). Similarly, in the present study, very few schools provided lockers, and even where available, students hesitated to use them due to fear of losing belongings, reducing the potential benefit of this infrastructure in lowering backpack weight.

Health consequences of carrying heavy school bags were strongly emphasized by participants. Consistent with an Ethiopian study reporting a 62% prevalence of musculoskeletal pain—particularly involving the shoulders, neck, and lower limbs—the present study also identified **shoulder and neck pain as the most common complaints** (169). Long walking duration (≥20 minutes) combined with heavier relative bag weight significantly increased pain and fatigue, reinforcing evidence that children carrying heavy bags and walking longer distances have up to 3.5 times higher risk of musculoskeletal discomfort (169).

Participants proposed several **practical strategies to reduce backpack weight**, many of which align with existing literature. Teachers suggested leaving books at school (10.3%), using integrated textbooks (9.3%), and adopting online assignments or digital learning (9.3%) (170). The growing role of Information and Communication Technology (ICT), especially accelerated during the COVID-19 pandemic, has demonstrated potential not only to enhance learning quality but also to reduce physical load on students (171). However, in the present study, limited resources, poor digital access, and inequities restricted widespread acceptance of e-learning solutions.

Curricular factors were also perceived as contributors to heavy backpacks. Many participants felt that the curriculum was excessively loaded, compelling students to carry multiple textbooks beyond their cognitive capacity. This perception is supported by Miller et al., whose findings, grounded in Cognitive Load Theory, suggest that curriculum reduction improves conceptual understanding by lowering intrinsic cognitive load (173). Suggestions such as **block scheduling** were discussed, although teachers expressed concerns about long class durations, scheduling difficulties, and increased workload (172).

The quantitative component of the study demonstrated the **effectiveness of the intervention program**. Among 1,404 students studied, 87.68% initially carried backpacks exceeding 10% of their body weight. In the experimental group, heavy backpack use declined significantly from 85.2% at baseline to 55.4% after five months, while the control group showed no meaningful improvement ($p < 0.001$). Comparable reductions were reported in Spain by Rodríguez-Oviedo et al. (174) and in Maharashtra by Ashtekar et al., where heavy bag prevalence dropped from 42% to 17% post-intervention (176). Ergonomic education in Iran similarly reduced mean bag weight from 3.41 ± 0.48 kg to 2.60 ± 0.86 kg (177).

Beyond backpack weight, the intervention positively influenced **health outcomes**. Moderate to severe upper and lower abdominal discomfort in the experimental group declined significantly after intervention ($p < 0.001$), a novel finding with limited comparative literature. Musculoskeletal pain prevalence, particularly in the shoulder and neck regions, was markedly reduced post-intervention, consistent with findings from Iran and Spain (174,177). In contrast, some studies have reported no significant pain reduction, highlighting contextual and methodological differences (180,183).

The intervention also resulted in **improved muscle strength**, whereas students in the control group experienced a decline over time. These findings align with studies demonstrating

improved muscle power following ergonomic interventions and reduced strength among heavy backpack users (184,185). Importantly, academic performance improved significantly in the experimental group (from 85.6% to 96.6%; $p < 0.05$), while it declined in controls, suggesting that physical comfort and reduced strain may indirectly enhance learning outcomes.

Stress levels showed a notable reduction in the intervention group, with severe to extremely severe stress decreasing from 17.2% to 8.1% ($p < 0.001$), while stress increased significantly in the control group. Although limited comparative literature exists, this finding underscores the broader psychosocial benefits of backpack weight reduction.

Analysis of **general and school-related factors** revealed no significant association between parental education and backpack weight, consistent with findings from Iran (187). However, undernourished children were significantly more likely to carry heavy backpacks ($p < 0.001$), a finding supported by studies from Greece and New Zealand (188,189). Duration of carrying the backpack (>30 minutes/day) was significantly associated with heavy load, reinforcing previous international evidence (174,188).

No consistent associations were found between backpack weight and mode of transport, carrying style, bag type, physical education classes, meditation, extracurricular activities, or canteen availability, aligning with several prior studies (188–190). Locker availability, although limited, showed mixed associations across studies (179,190). Interestingly, access to midday meals was significantly associated with lower backpack weight, a finding with limited comparable evidence and scope for future research.

In summary, the study demonstrates that **school-based educational and ergonomic interventions are effective in reducing backpack weight, musculoskeletal pain, stress levels, and improving muscle strength and academic performance**. Addressing policy awareness, curriculum load, and infrastructural support is essential for sustainable impact.

7. LIMITATIONS

- We depended on a self-reported questionnaire which can be subjective, i.e. presence of pain, experience of stress. Nevertheless, every effort was taken by the researcher to guarantee that each participant's reporting of this characteristic was consistent.

- Bias may exist because some students may have altered the backpack's weight after granting consent to participate in the study and before the weight of the bag was measured.

- The intervention that was given was just once during the school year, and it was not intensive.

8. CONCLUSION

A mixed method study was conducted among 1404 school students studying in 6^{th}, 7^{th}, and 8^{th} standard of selected schools in Kanyakumari District, Tamil Nadu. Initially, before giving intervention, a qualitative analysis was done among principals, teachers, students and parents of selected schools to assess the issues and challenges associated with heavy bag packs. This was followed by a study to look for the effectiveness of an intervention program for reducing backpack weight among school students. The study findings will have significant implications for school policies and public health.

Concluding the qualitative analysis as follows.

- Almost all the participants were unaware of the school bag policy 2020.
- There is a concerning lack of awareness among parents regarding maximum acceptable school bag weight.
- Very few schools had locker facility but students are not using it because of the fear of missing things
- Shoulder and neck pain were commonly reported among students and those who had to walk long distance suffered more pain and fatigue
- Utilization of Information and Communication Technology (ICT) teaching methods not only enhance educational quality but also addresses the pressing issue of heavy school bags, which can lead to serious health issues in children
- Instead of the much-loaded current academic curriculum, a reduced curriculum enhances students' comprehension of fundamental concepts.

In quantitative analysis, variables were checked for their value before and after intervention, and we can conclude as follows:

- There was significant reduction noted in the proportion of heavy backpack users in the experimental group as compared to the control group (p value <0.001) proving the effectiveness of the intervention.
- After intervention, the upper and lower abdominal discomfort has dropped significantly in the experimental group ($p<0.001$).
- Among the study participants, majority had reported to have shoulder pain, followed by pain in other parts of body. It was found that students in experimental group showed significant reduction in musculoskeletal pain/discomfort as compared to the students in control group ($p<0.001$). This means that the proposed program was effective in reducing the load, taking into account, and potentially preventing the occurrence of musculoskeletal pain among school students.

- Muscle power of the study participants was found to have significantly improved who received the intervention. And in the other group, there was a reduction in the muscle power. Intervention provided to them was effective in improvement of muscle power ($p<0.001$).
- Academic performance of the students in experimental group, after the backpack weight reduction intervention, had significantly improved (p value <0.001).
- The school backpack weight reduction intervention program was also found effective in reducing stress level among study subjects. (p value <0.001).
- Parent's education and the most mode of transportation to school was not found to be an associating risk factor of school backpack weight (p value = 0.15)
- BMI is an associating factor and underweight students are more likely to be affected by heavy school back packs (p value < 0.001).
- Though carrying backpack on both shoulders showed a positive association with school backpack weight (p = 0.01), other factors like way of carrying school bag and type of schoolbag was not related with the schoolbag weight (p value >0.05).
- Availability of PET class, meditation class and participation in extracurricular activity while in school showed no association with school bag pack weight in this study (p value > 0.5).
- With respect to availability and usage of lockers, nearly two thirds of the students who had access to lockers at school were using them. Availability of lockers was not an associating factor for school bag pack weight as found in this study (p value = 0.56).
- Availability of mid-day meal in schools was found to be an associating factor with the weight of (178)Availability of a canteen facility in the school had no association with the student's school back Pack weight (p value = 0.94).

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10. LIST OF SCHOLARLY ACTIVITIES

Copyright granted:

1. Copyright received for “Intervention exercise for reducing school bag weight” Registration Number L-150540/2024
2. Copyright applied for Questionnaire for reducing school back pack weights among school students at selected schools of Kanyakumari District Diary Number LD-34225/2025-CO

Papers published:

1. Bruce MP, Surekha A, Karnaboopathy R, Balan KS, Chavada VK, Boratne AV, Bobhate P, Raja TK. Assessment of the reliability and validity of visual analog scale for abdominal pain among selected school students from selected schools at Kanyakumari district. Journal of Family Medicine and Primary Care. 2025 Apr 1;14(4):1179-84. INDEXED IN WEB OF SCIENCE
2. Bruce P, Balan S, Chavada VK, Boratne AV, Bobhate P. Assessment of reliability and validity of the depression anxiety stress scale questionnaire among 6th, 7th, and 8th standard selected school students in selected schools at Kanyakumari district. Journal of Family Medicine and Primary Care. 2025 Oct 1;14(10):4396-9. INDEXED IN WEB OF SCIENCE
3. Bruce MP, Balan KS, Gopal L, Kiruthiga R. A Cross Sectional Study To Assess The Nutritional Status Among Post Covid Patients In A Tertiary Care Center At Kanyakumari District. Int J Acad Med Pharm. 2024;6(3):88-92.
4. Bruce Ms, Balan Ku. A Cross-Sectional Study On Impact Of Covid-19 Pandemic On The Mental Health Of School Children In Kanyakumari District. International Journal Of Medicine & Public Health. 2024 Jan 1;14(1).
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Papers presented:

International Conferences:

1. 1. Presented a paper titled “A Cohort Study on Incidence of Post COVID Sequelae and its Determinants among COVID-19 Health Care Workers in a Tertiary Care Centre “at International Hybrid Conference on 26 & 27 January 2024 Organized by Tamil Nadu Alliance for Development of Community Medicine.
2. Presented a paper titled “Knowledge and Attitude about the Harmful Effects of Carrying Heavy School Backpack among Principals of Selected Schools of Kanyakumari District “at International Conference and Workshop on ‘NAMS in Pharmacology and Toxicology Testing’ From 5–7 December 2024 Organized by MGMCRI Puducherry

3. Presented an online paper titled “Assessment of reliability and validity of DASS Questionnaire among 6,7,8 Standard selected school students in selected school at Kanyakumari District” at Vedant Biggest Virtual International Multidisciplinary Multi-lingual Online Conference.

2. **Poster presented:**

International Conferences:

1. Presented E-poster titled “Cross-sectional Study of Impact of COVID-19 Pandemic on Mental Health of School Children in Kanyakumari District” at International Hybrid Conference on 26 & 27 January 2024 Organized by Tamil Nadu Alliance for Development of Community Medicine.
2. .Presented E-poster titled “Knowledge and Attitude about the Harmful Effects of Carrying Heavy School Backpack among Parents of Students of Selected Schools of Kanyakumari District” From 5–7 December 2024 and received the **(Best Poster Award)** at International Conference and Workshop on ‘NAMS in Pharmacology and Toxicology Testing’ From 5–7 December 2024 Organized by MGMCRI Puducherry
3. Presented E-poster titled “Knowledge Attitude And Practice About The Harmful Effects Of Carrying Heavy School Back Pack Among Students Of Selected Schools In Kanyakumari District” and received the **(Best Poster Award)** at Hybrid International Conference on 21&22 February 2025 With TADCOM and SLNIMS, Puducherry.

National Conferences:

1.Presented E-poster titled “A cross sectional study to assess the nutritional status, prevalence of smoking among post COVID patients in a tertiary care center at Kanyakumari District, 2021” in National Conference at Chandigarh PGIMER, NCTOH on 25–27 Sep 2021

2. Presented E-poster on “Effectiveness of an Intervention for Reducing School Bag Weight among School Students at Selected Schools in Kanyakumari District, Tamil Nadu Mixed Method study – Pilot Study” On 6 December 2023 in National Symposium “GUT MICROBIOME IN HEALTH AND DISEASE INDIAN PERSPECTIVES” Organized By MGMCRI, SBV, Puducherry

11. FIRST PAGE FROM THE REPRINT OF THE PUBLISHED ARTICLES

Original Article

Assessment of the reliability and validity of visual analog scale for abdominal pain among selected school students from selected schools at Kanyakumari district

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Abstract

Introduction: School students often carry heavy school bags, which can contribute to various health issues, including abdominal pain. The relationship between heavy school bags and abdominal pain is an emerging concern among educators, healthcare professionals, and parents. Excessive weight from school bags is known to place strain on students' musculoskeletal systems, leading to discomfort, including abdominal pain. Despite growing concerns, there is a lack of research on using the Visual Analog Scale (VAS) to assess abdominal pain specifically among school students. This study investigates the reliability and validity of the VAS for measuring abdominal pain in school students, with the goal of improving pain assessment practices in this population. **Objectives:** Assess the validity of VAS scores for acute abdominal pain in school students. Determine the reliability of VAS scores for acute abdominal pain. Identify the minimum clinically significant difference in abdominal pain as measured by VAS. Methods: This prospective cohort study included school students aged 10-18 years in Kanyakumari District, Tamil Nadu. A multistage sampling method, followed by simple random sampling, was employed to select participants. A total of 200 students participated after accounting for a 10% loss to follow-up. The study involved two phases: an initial assessment using the VAS and standardized health questionnaires, followed by a follow-up assessment after two weeks for test-retest reliability. Data on demographics, pain intensity, and health history were collected, and reliability and validity testing were performed using statistical methods like Cronbach's alpha, Intraclass Correlation Coefficient (ICC), and Pearson's correlation coefficient. Results: The mean age of participants was 12.03 years (SD = 3.2), with a gender distribution of 54.5% female and 45.5% male. The VAS demonstrated high test-retest reliability (ICC = 0.87), indicating that it is a stable tool for assessing abdominal pain over time. A moderate positive correlation was found between age and pain intensity ($r = 0.65$, $p < 0.001$), suggesting that older students reported higher levels of abdominal pain. There were

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Original Article

Assessment of reliability and validity of the depression anxiety stress scale questionnaire among 6th, 7th, and 8th standard selected school students in selected schools at Kanyakumari district

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Abstract

Objective: To assess the validity and reliability of the DASS questionnaire among 6th, 7th, and 8th standard school students at selected schools in the District of Kanyakumari. **Methodology:** This cross-sectional study involved 200 students selected using a purposive sampling method. Data collection included the administration of the DASS questionnaire alongside demographic information. **Results:** Internal consistency was found to be strong. However, limitations included concerns regarding the sample's representativeness and potential cultural biases. **Conclusion:** The DASS questionnaire proved valid and reliable. The results highlight the need for culturally adapted mental health tools in public-health interventions.

Keywords: Adolescent mental health, depression anxiety stress scales, public-health intervention

Introduction

There has been growing global concern about mental health challenges faced by students, as they can greatly affect academic success, social interactions, and overall well-being.[1] The mental health issues that can negatively impact students' ability to succeed in academic settings.[2] Timely identification

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Section: Community Medicine

Original Research Article

A CROSS SECTIONAL STUDY TO ASSESS THE NUTRITIONAL STATUS AMONG POST COVID PATIENTS IN A TERTIARY CARE CENTER AT KANYAKUMARI DISTRICT

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Abstract

Background: Nutritional status of the population is an important public health issue which is often neglected. Both under nutrition and over nutrition are public health priorities. The aim of our study is to assess the nutritional status of patients who recovered from COVID-19 and were admitted in ward and intensive care unit. **Materials and Methods:** A comparative hospital based cross-sectional study was done among 106 post COVID patients attending the Post COVID clinic of Kanyakumari Government Medical College, Asaripallam, who were discharged from COVID wards or ICU 2 weeks prior to the clinic visit, to assess their nutritional status. A systematic random sampling was adopted to select the study subjects and data was collected using a Modified Mini Nutritional Assessment Questionnaire. **Result:** The Mean age and standard deviation of the participants were 44.5 ± 15.380 and the mean BMI and standard deviation of the participants were 24.79 ± 3.70.Among the post COVID previously admitted in COVID ward and COVID ICU, majority (70.75%) were having a normal nutritional status and only 4.7 % were malnourished. When the nutritional status of the patients admitted in ICU and wards were compared, none of the patients admitted in ward were having malnutrition when compared to 25% admitted in ICU. **Conclusion:** The nutritional status assessment of the post COVID patients revealed that only 4.7 % were malnourished. And among those who were malnourished most of them were admitted previously in COVID ICU compared to wards.

INTRODUCTION

Health of an individual is contributed by many factors and one of the most important factors among them is nutrition. The nutritional status of an individual is influenced by certain aspects and malnutrition is an important area of concern which is often neglected. The infection - malnutrition cycle affects the productivity of an individual leading to economic devastation of the country as a whole making it an important public health priority.[1] The COVID 19 pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which has spread rapidly around the world during 2020 made the situation worse.[2] The clinical manifestations of the disease varied widely, ranging from asymptomatic forms to severe acute respiratory distress syndrome (ARDS) requiring hospitalization, assisted ventilation, and intensive care unit (ICU) admission, with high mortality risk.[3] The nutritional status of individuals post admission varied drastically from the pre-admission state. The overall prevalence of malnutrition was 42.1% (moderate: 23.7%, severe: 18.4%).[4] The prevalence of malnutrition reached upto 66.7% among patients admitted in ICU.[5] On the other side, an individual who is already malnourished, is more vulnerable for COVID 19 and when the person contracts the disease, it leads to severe complications.[6] Early detection of malnutrition may mitigate COVID-19 associated malnutrition and helps in fast recovery.[7] Prolonged

Section: Community Medicine

Original Research Article

A CROSS-SECTIONAL STUDY ON IMPACT OF COVID-19 PANDEMIC ON THE MENTAL HEALTH OF SCHOOL CHILDREN IN KANYAKUMARI DISTRICT

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ABSTRACT

Background: The COVID-19 pandemic declared as a global health emergency by World Health Organisation on March 24 2020, had many impacts on the health of the people especially mental health of children.
Objectives: To find the impact of COVID-19 pandemic on mental health and to determine the associated factors among children studying in various schools of Kanyakumari District of Tamil Nadu.
Material and Methods: A cross-sectional study was conducted among 400 school children selected through convenient sampling studying in selected schools of Kanyakumari District. A questionnaire covering 4 different domains with minimum score as 0 and maximum as 41, grouped as normal (> 30), borderline (15-30) and abnormal (<15) was used for data collection. The data collected was entered into MS excel and was analysed using SPSS version 26.0.
Results: Among the study participants 14 % of adolescents had abnormal mental health status, which was more among girls (15.7%) and around 67.5% of the adolescents had Borderline mental health status, which was more among boys (70.45%) and this association was found to be statistically significant ($p < 0.001$).Physical health factors domain was the most affected among girls (20.56%) and educational factors were affected the most among boys (19.54%) and these associations were found to be statistically significant.
Conclusion: Effective mental health promotion strategies that are tailored to the needs of boys and girls has to be in place starting from schools.
Keywords: Mental health, school children, Kanyakumari.

INTRODUCTION

The novel Coronavirus disease 2019 (COVID-19) is an illness caused due to Coronavirus-2 (SARS-CoV-2). The first case of COVID 19 was identified in Wuhan, China, during December 2019. The disease got quickly spread worldwide, resulting in the COVID-19 pandemic. Owing to its spread, on 24th April 2020, the World Health Organization (WHO) has declared this outbreak as a global health emergency. There have been 48,196,862 confirmed cases of COVID-19, including 1,226,813 deaths, reported to WHO since 2019.[1] As a control measure to stop the spread of the disease, lockdown measures were instituted in many countries including India. During lockdown, children were forced to stay home for extended periods due to closure of schools. Children were the most affected ones by the harmful effects of these measures, as they were unable to interact with their friends and other physical activities were restricted.[2] All these have harmful impact on children's mental health and welfare which eventually leads to anxiety, stress, depression, and sleeping difficulties. It is necessary to follow-up the school children and to do comprehensive assessments for early detection of these health issues and appropriate management of their psychological, physical, and social function.[3] Yet, there are no relevant literature available in Tamil Nadu on the long-term impact of COVID-19 pandemic on

Section: Community Medicine

Original Research Article

KNOWLEDGE AND ATTITUDE OF SCHOOL TEACHERS ABOUT THE HARMFUL EFFECTS OF CARRYING HEAVY SCHOOL BACK PACKS IN STUDENTS FROM SELECTED SCHOOLS OF KANYAKUMARI DISTRICT, SOUTH TAMIL NADU

Praythiesh Bruce[1], Prateek Bobhate[2], Abhijit Vinodrao Boratne[3],K.U.Suresh Balan[4]

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DOI:10.5530/ijmedph.2024.1.57

Source of Support: Nil,
Conflict of Interest: Nonedeclared

Int J Med Pub Health
2024; 14 (1); 300-304

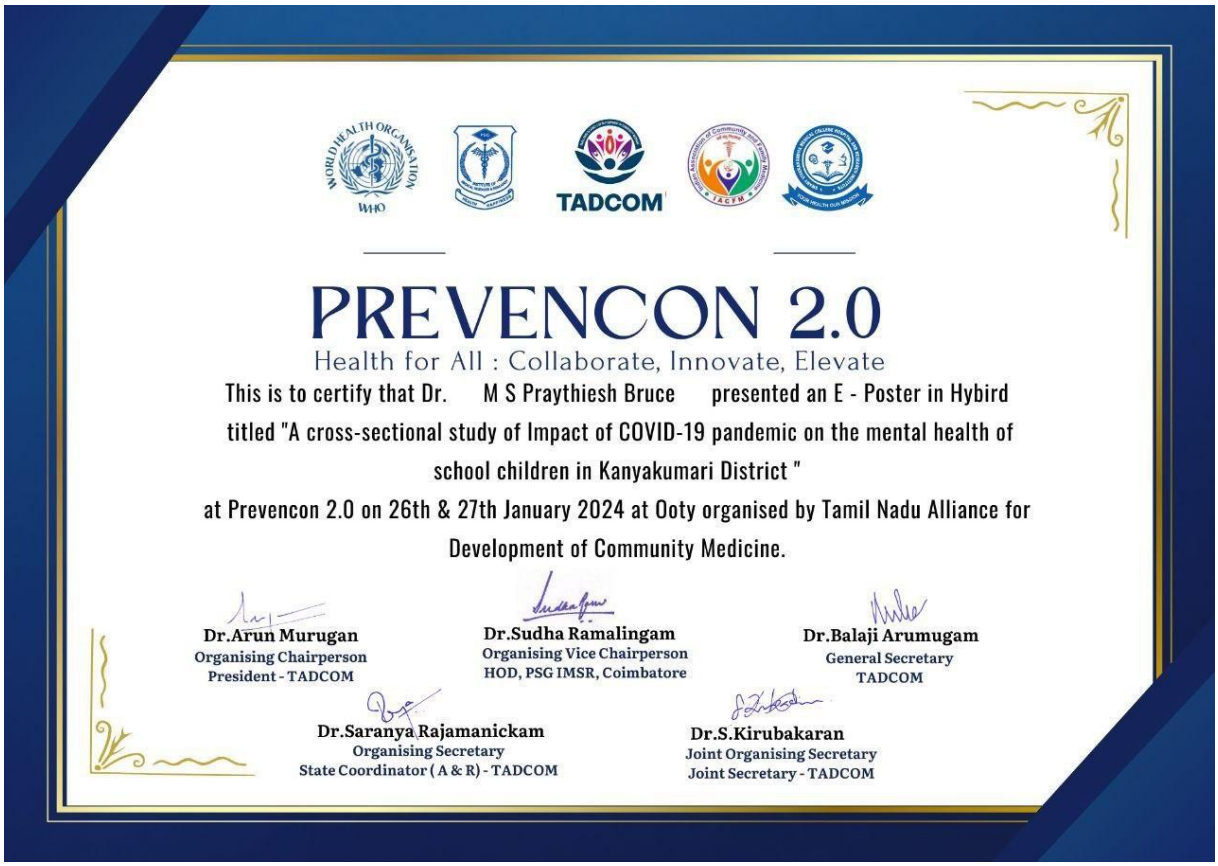
ABSTRACT

Background: School education is an important part of child's overall growth. But, during the process of attaining school education, children are burdened with heavy back packs which can cause serious health issues. **Objectives:** The objectives of the study were to assess the knowledge and attitude of school teachers about the ill effects of carrying heavy back packs in children.
Materials and Methods: A school based cross sectional study was done among 264 school teachers teaching 6th to 8th standard selected through multistage stratified random sampling technique from selected schools of Kanyakumari district from May 2022 to May 2023. Data collected using a predesigned pre tested and self-administered questionnaire was entered into MS Excel and was analysed using SPSS version 26.0.
Results: The results revealed that only 31.8 % of the school teachers knew that the ideal proportion of back packs, 56.4 % knew that the heavy bag packs can cause headache, neck pain and leg pain, 49.2 % knew that it causes shoulder pain and 43.6% knew that it causes back pain in students. For questions on attitude, 20.5 % and 42% of them agreed that heavy back packs can be a reason for tiredness and that it can cause mental stress, respectively.
Conclusion: While only half of the participants were knowledgeable about the physical effects of heavy back packs in students, less than half of them were of the attitude that it can have mental and emotional effects.
Keywords: Knowledge, attitude, heavy back packs, school teachers, Tamil Nadu.

INTRODUCTION

An important part of a child's overall growth is their education in schools. The school education formally takes place within a school under a specially designed curriculum including the necessary books as per the standard, facilitated by school heads, teachers and other non-teaching staff of the school. The students spend hours in school, lasting from morning till afternoon or evening, in most of the days of a whole year.[1] But many a times, during the process of attaining school education, children are burdened with heavy back packs which can cause serious health issues as well as problems in the overall development. Various studies conducted in different parts of the world suggest that carrying heavy school backpacks can be a reason for increase in the incidence of low back pain, abnormal posture, and other musculoskeletal problems among school going children[2–8].It can cause severe shoulder pain, leg pain and headache besides affecting their spinal posture, foot shape, and gait.[1,2,3] It may also

12. ANNEXURES



PREVENCON 2.0

Health for All : Collaborate, Innovate, Elevate

This is to certify that Dr. M S Praythiesh Bruce presented an E - Poster in Hybird titled "A cross-sectional study of Impact of COVID-19 pandemic on the mental health of school children in Kanyakumari District " at Prevencon 2.0 on 26th & 27th January 2024 at Ooty organised by Tamil Nadu Alliance for Development of Community Medicine.

Dr.Arun Murugan
Organising Chairperson
President - TADCOM

Dr.Sudha Ramalingam
Organising Vice Chairperson
HOD, PSG IMSR, Coimbatore

Dr.Balaji Arumugam
General Secretary
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Dr.Saranya Rajamanickam
Organising Secretary
State Coordinator (A & R) - TADCOM

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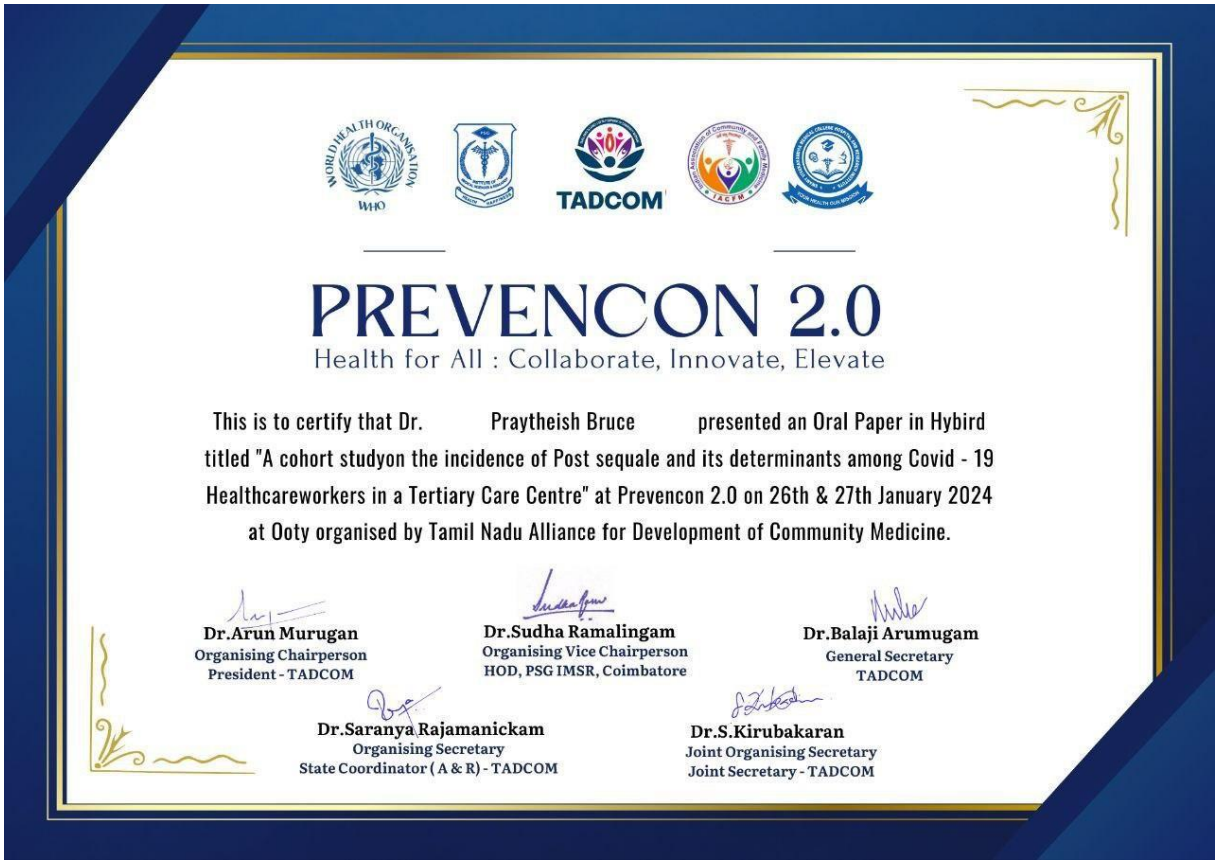

PREVENCON 2.0

Health for All : Collaborate, Innovate, Elevate

This is to certify that Dr. Praytheish Bruce presented an Oral Paper in Hybird titled "A cohort studyon the incidence of Post sequale and its determinants among Covid - 19 Healthcareworkers in a Tertiary Care Centre" at Prevencon 2.0 on 26th & 27th January 2024 at Ooty organised by Tamil Nadu Alliance for Development of Community Medicine.

Dr.Arun Murugan
Organising Chairperson
President - TADCOM

Dr.Sudha Ramalingam
Organising Vice Chairperson
HOD, PSG IMSR, Coimbatore

Dr.Balaji Arumugam
General Secretary
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Puducherry - 607 402, India

Certificate of Participation

This is to certify that Dr/Mr/Ms/Mrs..... **M.S.Praythiesh Bruce** *..... has participated/given oral presentation/presented poster in the International Symposium on,* **"CURRENT TRENDS AND FUTURE PERSPECTIVES OF NUCLEIC ACIDS RESEARCH IN HEALTH & DISEASES"** *organized by Mahatma Gandhi Medical Advanced Research Institute (MGMARI), in collaboration with Frontier Institute for Biomolecular Engineering Research (FIBER), Japan and support from JSPS Core to Core Project, JSPS, JAPAN on November 30 and December 1, 2023 at Sri Balaji Vidyapeeth (SBV), Puducherry.*

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Organizing Secretary
MGMARI, SBV

Dr. S. R. Rao
Vice-president
(Research Innovation & Development), SBV

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Vice - Chancellor
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Certificate of Appreciation

This certificate is presented to

Dr. Praythiesh Bruce

Shri Sathya Sai Medical College and Research Institute, SBV

for presenting a poster titled

"Effectiveness of an Intervention for reducing school back pack weights among school students at selected schools in Kanyakumari District, Tamilnadu –A Mixed Methods Study –PILOT STUDY"

in the national symposium on "Gut Microbiome in Health and Disease: Indian Perspectives" Jointly Organized by Mahatma Gandhi Medical Advanced Research Institute (MGMARI) & Indira Gandhi Institute of Dental Sciences (IGIDS), Sri Balaji Vidyapeeth (SBV), Puducherry, on 6th December 2023

Dr. R. Dhamodharan
Organising Secretary
Asst. Prof, MGMARI, SBV

Dr. Santha Devy
Organising Secretary
Prof, IGIDS, SBV

Dr. Aruna
Principal, IGIDS, SBV

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Vice President
Research, Innovation & Development, SBV

MAHATMA GANDHI MEDICAL ADVANCED RESEARCH INSTITUTE
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(DEEMED TO BE UNIVERSITY)
Puducherry,India

CERTIFICATE OF APPRECIATION

This is to certify that **Mr. M.S.Praythiesh Bruce** from **Shri Sathya Sai Medical College and Research Institute, Chennai** has presented an Oral presentation entitled **"Knowledge and attitude about the harmful effects of carrying heavy school back packs among principals of selected schools of Kanyakumari District, South Tamil Nadu"** in a three-day **International Conference and Workshops on "New Approach Methodologies (NAMs) in Pharmacology and Toxicology Testing"**, A Satellite program to the 4thAsian Congress for Alternatives to Animal Experiments (ACAAE) and 7thAnnual conference of Society for Alternatives to Animal Experiments – India (SAAE-I) organised by Mahatma Gandhi Medical Advanced Research Institute – Sri Balaji Vidyapeeth (NAAC++) from December 5-7, 2024.

Dr.Veni Subramanyam	Prof.R.Raveendran	Prof.NiharRanjanBiswas	Prof.M.Akbarsha
Organizingsecretary, MGMARI	Convener&Director, MGMARI	Vice Chancellor, SBV	GeneralSecretary, SAAE-I

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SRI BALAJI VIDYAPEETH
(DEEMED TO BE UNIVERSITY)
Puducherry, India

CERTIFICATE OF APPRECIATION

This is to certify that **Mr. M.S.Praythiesh Bruce** from **Shri Sathya Sai Medical College and Research Institute, Chennai** has presented a Poster presentation entitled **"Knowledge and attitude about the harmful effects of carrying heavy school back packs among parents of students of selected schools of Kanyakumari District, South Tamil Nadu"** in a three-day **International Conference and Workshops on "New Approach Methodologies (NAMs) in Pharmacology and Toxicology Testing"**, A Satellite program to the 4th Asian Congress for Alternatives to Animal Experiments (ACAAE) and 7th Annual conference of Society for Alternatives to Animal Experiments – India (SAAE-I) organised by Mahatma Gandhi Medical Advanced Research Institute – Sri Balaji Vidyapeeth (NAAC ++) from December 5 - 7, 2024.

Dr. Veni Subramanyam	Prof. R. Raveendran	Prof. Nihar Ranjan Biswas	Prof. M.A. Akbarsha
Organizing secretary, MGMARI	Convener & Director, MGMARI	Vice Chancellor, SBV	General Secretary, SAAE-I

SRI BALAJI VIDYAPEETH
Examinations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
Dr. **S. SRIRANGARAJ**
Controller of Examinations

Date: 21-06-2023

No. SBV/COE/Ph.D/A5

UNIVERSITY MEMORANDUM

Sub : Sri Balaji Vidyapeeth – Ph.D Degree in Part – I Course Work Assessment – Results Notified.

* * * * *

Mr/Mrs/Dr. **PRAYTHIESH BRUCE M S,** UIN. **2005002001** Research Scholar in Medicine (Part Time - External) is declared to have passed the Ph.D Part-I – Course Work Assessment and he/she is permitted to continue the research under the guidance of Dr. **PRATEEK BOBHATE** and submit the thesis for the award of Ph.D Degree as per the regulations of SBV.

Sl. No.	Subjects	Result Status
1	PAPER - I RESEARCH METHODOLOGY AND BIOSTATISTICS	**PASS**
2	PAPER - II ON CHOSEN FIELD OF RESEARCH	**PASS**

SRI BALAJI VIDYAPEETH * CONTROLLER OF EXAMINATIONS * PONDICHERRY

S. Sriranjaraj
CONTROLLER OF EXAMINATIONS

To : Mr/Mrs/Dr. **PRAYTHIESH BRUCE M S**

CC : Dr. **PRATEEK BOBHATE**, Prof. & Head of community Medicine, SSSMCRI.

SWAYAM ONLINE COURSE CERTIFICATION

This Certificate is awarded to

M S PRAYTHIESH BRUCE

Roll No:TN10061612

for successfully completing the 2 credit course

Research and Publication Ethics (RPE)

with a consolidated score of 56% marks

in the proctored examination held on 19-May-24

offered by ***Dr. Anirban Ghosh*** *of*

Netaji Subhas Open University, Kolkata

Prof. Uma Kanjilal
National Coordinator / Registrar, SED
Indira Gandhi National Open University, New Delhi

Issued On: 20/06/2024

Smt. Ananya Mitra
Registrar(Addl.Charge)
Netaji Subhas Open University, Kolkata

INSTITUTIONAL ETHICS COMMITTEE
KANYAKUMARI, STATE OF TAMIL NADU, SOUTH INDIA, PIN:629201
04652223201; 04652223202
deankgmch@yahoo.com, www.kkmc.ac.in

CERTIFICATE OF REGISTRATION & APPROVAL OF THE IEC

REF NO: F-006/IEC/2022

PROTOCOL TITLE: Effectiveness of an Intervention for reducing school back pack weights among school students at selected schools in Kanyakumari District, Tamil Nadu- a mixed methods study.

PRINCIPAL INVESTIGATOR: Dr. M S Praythiesh Bruce, MD(Community Medicine).,

DESIGNATION OF PRINCIPAL INVESTIGATOR: Assistant Professor of Community Medicine

DEPARTMENT & INSTITUTION: Department of Community Medicine, Kanyakumari Govt. Medical College, Asaripallam

Dear Dr. M S Praythiesh Bruce, MD(Community Medicine).,Kanyakumari Govt. Medical College Institutional Ethics Committee reviewed and discussed your application during the IEC meeting held on 05.08.2022.

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
6.	Proposed Methods for Patient Accrual Proposed	☐
7.	Curriculum Vitae of the Principal Investigator	☐
8.	Insurance / Compensation Policy	☐
9.	Investigator's Agreement with Sponsor	☐
10.	Investigator's Undertaking	☐
11.	DCGI/DGFT approval	☐
12.	Clinical Trial Agreement (CTA)	☐
13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	☐

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3 weeks before for renewal / extension of the validity
4. An annual status report should be submitted
5. The IEC will monitor the study
6. At the time of PI's retirement/leaving the institute, the study responsibility should be transferred to a person cleared by HOD.
7. The PI should report to IEC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should receive the SAE reporting form withing 24 hours of the occurrence.
8. In the events of any protocol amendments, IEC must be informed and the amendments should be highlighted in clear terms as follows:
   - a. The exact alteration/ amendment should be specified and indicated where the amendment occurred in the original Project. (Page no. Clause no. etc.)
   - b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
   - c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval. If the amendment demands are look at the toxicity or side effects to patients, the same should be documented.
   - d. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IEC, only then can they be implemented.
   - e. Approval for amendment changes must be obtained prior to implementation of changes.
   - f. The amendment is unlikely to be approved by the IEC unless all the above information is provided
   - g. Any deviation/violation/waiver in the protocol must be informed.

STANDS APPROVED UNDER SEAL

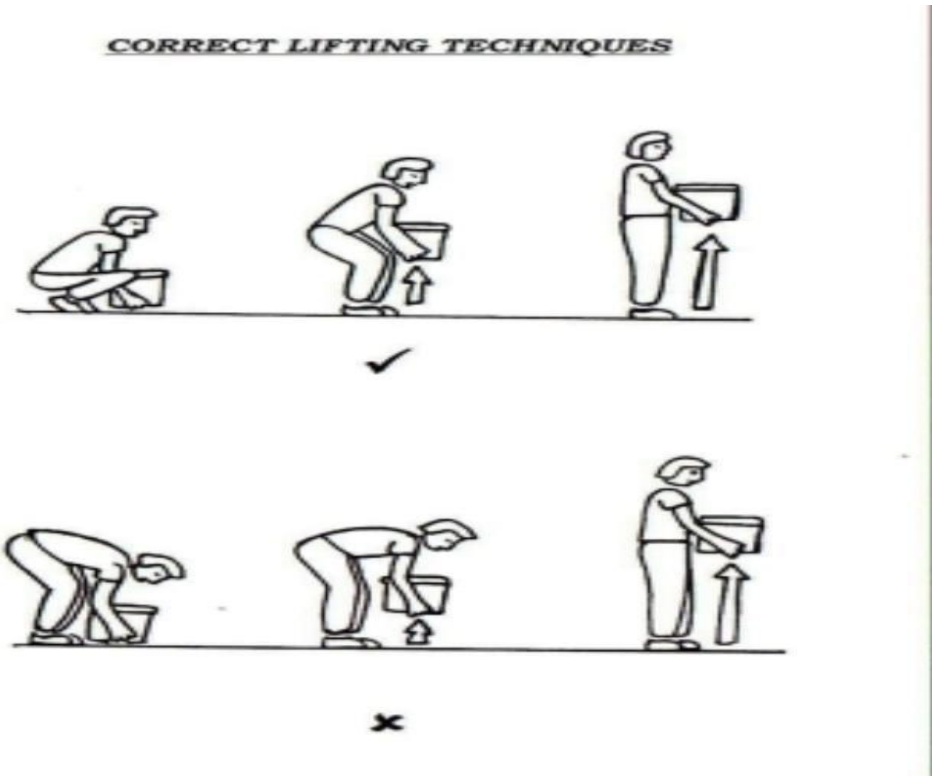
MEMBER SECRETARY
INSTITUTIONAL ETHICAL COMMITTEE
KANYAKUMARI GOVT. MEDICAL COLLEGE
ASARIPALLAM - 629 201

CHECKING BODY WEIGHT WITH SCHOOL BAG WEIGHT

CHECKING SCHOOL STUDENTS' HEIGHT

WRIST AND HAND EXERCISES DEMONSTRATION:

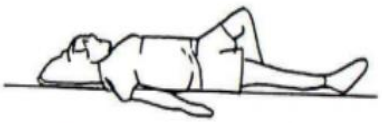
PAMPLETS:



NECK AND HIP EXERCISE PAMPLETS:

-2-

- கால்முட்டுகள் மடக்கி நிமிர்ந்து கிடக்கவேண்டும் — Lie on your back with knees bend
- கைகள் நடுவின் அடியில் வைக்கவேண்டும் — Rest your hand under your low back
- பின் பக்கம் பூரணமாக கைகளில் அமர்த்தவேண்டும். — Try to feel your whole back on the hand Be sure not to hold breath
- மூச்சு பிடித்து வைக்காமல் 5-10 நிமிடம் இப்படி செய்யவேண்டும். — Hold 5-10 seconds Relax



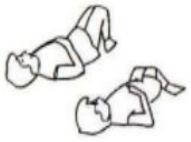
- நிமிர்ந்து படுக்கவேண்டும். — Lie on your back
- முட்டுகள் மெல்ல மடக்குவதும் நிவர்த்துவதும் செய்ய வேண்டும் — Slowly bend and Straighten Knee

- நிமிர்ந்து படுக்கவேண்டும். — Lie on your back with left knee bend
- ஒரு கால் மடக்கி மற்று கால் நிமிர்த்தி வைக்கவேண்டும் — Raise the right leg without bending the knee
- நிமிர்த்தி வைத்த கால் 8-10 இஞ்ச மேலே பார்த்து உயர்த்துக. — Right leg should be raised only to the height of left thigh
- 5-10 நிமிடம் இப்படி தூரவேண்டும். — Hold for 5-10 seconds Return to
- மறுகாலிற்கு இது போல் செய்யவேண்டும். — starting position Repeat on opposite side

-3-

- நிமிர்ந்து படுத்து ஒரு முட்டு மடக்கி நெஞ்சோடு சேர்த்து வைக்கவேண்டும். — Lie on your back pull one knee towards your chest
- 5-10 நிமிடம் இப்படி செய்யவேண்டும். — Hold 5-10 seconds Relax
- மற்றொரு காலிற்கும் இது செய்யவேண்டும் — Repeat the same on the other side

- நிமிர்ந்து படுத்து இரண்டு முட்டுகளும் நெஞ்சோடு சேர்த்து வைக்கவேண்டும். — Lie on your back pull both knees to your chest
- 5-10 நிமிடம் இப்படி செய்யவேண்டும். — Hold 5-10 seconds Relax



Lie on your back with both knees bend

Turn your knees to left rolling your hip

Do not lift right shoulder from the ground

- முட்டுகள் இரண்டும் மடக்கி வைக்கவேண்டும்
- முட்டுகால்கள் இரு பக்கங்களிலும் சரிக்கவேண்டும — Hold for 5-10 seconds Return to starting position
- 5-10 நிமிடம் இப்படி செய்யவேண்டும். — Repeat on opposite side

Activate Windows
Go to Settings to activate